
Rainfall intensification in tropical semi-arid regions: the Sahelian case

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Résumé

An anticipated consequence of ongoing global warming is the intensification of the rainfall regimes meaning longer dry spells and heavier precipitation when it rains, with potentially high hydrological and socio-economic impacts. The semi-arid regions of the intertropical band, such as the Sahel, are facing particularly serious challenges in this respect since their population is strongly vulnerable to extreme climatic events. Detecting long term trends in the Sahelian rainfall regime is thus of great societal importance, while being scientifically challenging because datasets allowing for such detection studies are rare in this region. This study addresses this challenge by making use of a large set of daily rain gauge data covering the Sahel (defined in this study as extending from 20°W–10°E and from 11°N–18°N) since 1950, combined with an unparalleled 5 minute rainfall observations available since 1990 over the AMMA-CATCH Niger observatory.

The analysis of the daily data leads to the assertion that a hydro-climatic intensification is actually taking place in the Sahel, with an increasing mean intensity of rainy days associated with a higher frequency of heavy rainfall. This leads in turn to highlight that the return to wetter annual rainfall conditions since the beginning of the 2000s-succeeding the 1970–2000 drought-is by no mean a recovery towards the much smoother regime that prevailed during the 1950s and 1960s. It also provides a vision of the contrasts existing between the West Sahel and the East Sahel, the East Sahel experiencing a stronger increase of extreme rainfall.

This regional vision is complemented by a local study at sub-daily timescales carried out thanks to the 5 minute rainfall series of the AMMA-CATCH Niger observatory (12000 km²). The increasing intensity of extreme rainfall is also visible at sub-daily timescales, the annual maximum intensities have increased at an average rate of 2%–6% per decade since 1990 for timescales ranging from 5 min to 1 hour. Both visions-regional/long term/daily on the one hand, and local/27/years/sub-daily, on the other-converge to the conclusion that, rather than a rainfall recovery, the Sahel is experiencing a new era of climate extremes that roughly started at the beginning of this century.

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Mots-Clés: Sahel, hydrological cycle intensification, extreme rainfall, sub, daily rainfall trends